

Since I live only a few miles from the New Jersey shore, I was among the millions who suffered an almost complete loss of communications after Sandy. I was barely able to get a few text messages to family and friends, since my landline failed, I could not use my Internet Service Provider due to lack of power, and my wireless cellular provider was operating in a highly degraded mode. As a telecommunications researcher, focused on delivering high bandwidths to users, I have since given some thought to network resilience.

I would like to present two ideas for consideration. The convergence of the cellular industry on a common standard, 4G LTE, offers an opportunity, previously unavailable in the US, to build robustness across competing carriers during man-made and natural disasters. Aggregating resources in a temporary mega-merger of all cellular carriers, on the airlink and the backhaul, would allow emergency communications to be provided to customers. On the airlink, our research[1] has shown that if two identical carriers pool their resources, they can, in the best case, double the capacity delivered to each customer, even as their combined pool of customers doubles. Equivalently, this means near normal service can be maintained even if half the cell towers of each of the two carriers are lost during a disaster. This would require that, during a disaster, carriers open their networks to cellphones from any carrier. This temporary merger was put into effect by AT&T and T Mobile after Sandy, and was facilitated by their use of compatible cellular standards. With the universal transition to the 4G LTE standard, this temporary mega-merger will soon be possible for all carriers, not just AT&T and T Mobile. This will be immensely helpful in a disaster, since it takes advantage of the inherent diversity in other aspects of carrier networks: Their choice of backup power sources, cell towers, and backhaul networks. It is less likely that vital components of all of the carriers fail simultaneously and in the same location. Thus a temporary mega-merger would increase the likelihood of providing service after a disaster.

A related idea is analogous to opening your WiFi access to neighbors when they need it. For this to work, carriers need to aggressively distribute femtocells to their customers at nominal cost and make sure that they can be opened, i.e. unlocked, to all cellular customers when required, not just their own subscribers. Opening residential femtocells to all cellular users would allow islands of service even if all macrocells and/or their backhaul networks failed. This implicitly would use the fact that many residential users have their own power supplies, and use different ISP providers, each with their own backhaul. This diversity would allow a cellular network, providing both voice and data services, to operate in each neighborhood.

These are two examples of using diversity across wireless and wireline carriers to provide inherent robustness in service. Clearly a regulatory and policy environment that encourages cooperation between competing service providers would be needed to bring this vision to fruition. An advantage of this approach is the relatively modest incremental cost.

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[1] "The Urge to Merge: When Cellular Providers Pool Capacity," by Sha Hua, Pei Liu and Shivendra S. Panwar, Proceedings of the IEEE ICC, 2012.